CLAIMS

1. Arrangement preferably comprised in a CAN system for making more efficient the utilization of available bandwidth on the system's bus connection between, from and/or to modules incorporated in the system and/or reduction of accuracy requirements of clock functions utilized in the system, the system working with a communication carried out on the bus connection, which communication operates in accordance with rules set up in the system and constitutes a combination of event-driven and time-controlled communication functions, characterized in that the said functions, together with a rule change in the time-controlled communication function, are arranged to achieve the said making more efficient and/or reduction, which rule change is arranged to give rise to deliberate collisions between messages appearing on the bus connection.

2. Arrangement according to Claim 1, characterized in that a virtual time schedule that is used is arranged to ensure that each message, at least those that occur in normal operating conditions, is allocated a time according to a virtual clock where the transmission of the message is to commence in ideal conditions; in that each module is able to be allocated an actual schedule, related to an actual clock in the module, for transmission of the message; in that the time of transmission is arranged to be earlier than the time allocated in the virtual schedule; and in that the actual clocks in the modules are set in relation to the virtual clock.

3. Arrangement according to Claim 1 or 2, characterized in that the different nodes are arranged to base their time in relation to the virtual clock on different references in the system.

4. Arrangement according to Claim 1, 2, or 3, characterized in that the different nodes are arranged to be synchronized in different ways; in that each node sets the time for transmission and reception of messages within a given tolerance in relation to the virtual clock and the part of the virtual schedule that concerns the respective node; in that transmission attempts are arranged to be commenced when the bus is free; in that slots arise in the communication; and in that the transmission takes place in the preceding time slot and a collision detecting mechanism comprised in the system enables the message to be sent as soon as possible, whereby the highest possible bandwidth utilization is made possible.

5. Arrangement according to Claim 2, 3 or 4, characterized in that the actual schedule is arranged to oscillate depending upon how long pre-initiation ("pre-ignition") is indicated, the length of the messages, the deviations of the local clocks from the virtual time for transmission which, for example, occurs at half the previous time slot according to the virtual schedule; and in that the maximum deviation between the virtual clock and the clocks of the sending and receiving modules is less than half the time slot.

6. Arrangement according to Claim 5, characterized in that the receiving module is arranged to interpret or determine that a message that is commenced within the previous time slot according to the virtual schedule and is concluded within the current time slot belongs to the current time slot; in that by means of utilization of a tolerance introduced on the actual schedule instead of on the message's appearance within the schedule, a more efficient utilization of available bandwidth is achieved, while retaining the advantage of time-scheduled systems that the identity of the message can be determined by where it appears in the schedule;

and in that pre-initiation ("pre-ignition") is reduced by the use of CAN by at least one bit time in order to ensure that an arbitration function comprised in the system does not come into effect in the event of a collision.

7. Arrangement according to any one of the preceding claims, characterized in that each message is provided with a unique identity, whereby a redundancy arises in the communication which is able to be utilized for the making more efficient and/or the reduction.

8. Arrangement according to any one of the preceding claims, characterized in that messages are arranged to be able to be transmitted in time slots on both sides of the allocated time slot, which is carried out by allowing a greater deviation from the virtual clock than half a time slot; and in that messages are arranged to change places, which is made possible because they are provided with an identity and the module concerned, its receiver, sorts out the correct message, which is made possible by the number of possibilities being limited in advance and by availability of the requisite bandwidth being ensured in advance.

9. Arrangement according to any one of the preceding claims, characterized in that the length of the respective time slot can be reduced also in the event of handling of stuffing bits; and in that the margin for the length of the time slots can be reduced by 12% in comparison to the requirements relating to the lengths of the time slots on the basis of stuffing bits of 24%.

10. Arrangement according to any one of the preceding claims, characterized in that by allowing the real-time time schedule to vary, by utilizing collision detection

without discard with immediate transmission after the termination of the collision and by using a unique identity for each message and, in addition, by utilizing the CAN characteristic that each identity is associated with a unique priority and by a discarded message being retransmitted immediately depending on its priority, the making more efficient or the reduction is achieved; in that by allowing the automatic retransmission and co-ordinating the allocated time slot with the message's priority, the communication's characteristics are tailored according to the requirements of the total system; and in that if the previous message has higher priority than the next, the previous message goes out on the bus immediately in the event of retransmission.

11. Arrangement according to any one of the preceding claims, characterized in that lost messages compete with subsequent messages in the same way; in that if all following messages have lower priority, the retransmission will result in the following messages being displaced one time slot; in that if the following message has higher priority than the discarded message, the discarded message will not go out onto the bus connection until there is a message with lower priority or the bus connection becomes free; and in that in this way an essentially 100% bus connection utilization is achieved by means of a short and easily predicable waiting time for each message.

12. Arrangement according to any one of the preceding claims, characterized in that by arranging the system so that it allows messages to change position in the virtual schedule within given limits, it is made possible that alarm messages are not sent according to schedule, in spite of the fact that the main part of the available bandwidth for the normal communication is utilized.

13. Arrangement according to any one of Claims 1-12, characterized in that with the use of protocols, for example CAN, where each message has a unique priority in the system and retransmission is carried out of messages that have been discarded.

14. Arrangement according to any one of Claims 1-13, characterized in that with the use of protocols, for example CAN, where each message has a unique priority in the system, the selected priority increases with increasing transmission time in order to make impossible immediate retransmission of messages that have been discarded.

15. Arrangement according to any one of Claims 1-14, characterized in that the system comprises a hierarchy of virtual clocks; and in that even if the system is complex or extensive and is basically time-controlled, one or more, even in an extreme case all, of the modules are arranged without a physical clock or clocks.

16. Arrangement according to any one of Claims 1-15, characterized in that the actual schedule is constructed by the respective modules being programmed to send their messages in relation to the virtual schedule.

17. Arrangement according to any one of Claims 1-16, characterized in that characteristics in the CAN system can be used in order to make possible the carrying out of other functions than those that are possible with the known technology or with the known system or systems.

18. Arrangement according to any one of Claims 1-17, characterized in that it is arranged to work with a

slot allocation and/or slot length that varies depending upon the module's event or function; and in that, for example, for the transfer of critical values, the transfer takes place more tightly or more often with more tightly spaced or more often appearing time slots than is the case when transfer is carried out of smaller or uncritical values; and/or in that the transfer interval is changed in the event of the occurrence of a change in the value.

19. Arrangement according to any one of Claims 1-18, characterized in that it works with a combination of event-driven and time-based scheduling.

20. Arrangement according to any one of Claims 1-19, characterized in that it is arranged essentially to achieve an increase in performance for the system by means of the advantages that it provides.